EPA-1564

"Christopher Elliott"
<USCEL@icopal.com>
03/14/2012 05:44 PM

To Phil North
cc
bcc
Subject Teranap - Life Expectancy

2 attachments


Casper Alcova RTD Report June 29 2011.pdf


Casper Alcova Commentary July 2011.pdf

Phil,

Thank you for returning my call earlier today. As promised, please find attached some further information on the life expectancy of our bituminous geomembrane. This should provide a realistic understanding of how well the membrane will hold up in a real world exposed application.

You were mentioning that there was a project where they were potentially considering using a bituminous liner for a tailings facility in Alaska. Would you you be able to tell me the name of the projects and which firms are looking after the design?

Enjoy the rest of your week.

(See attached file: Casper Alcova RTD Report June 29 2011.pdf)(See attached file: Casper Alcova Commentary July 2011.pdf)

Best regards,

Christopher Elliott
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DATE: 15 July 2011

FROM: Tim Kersey

SUBJECT: Casper Alcova Irrigation District
Teranap 431 Canal Liner Project: 20-Year Evaluation

Siplast Teranap 431 SBS-modified bitumen geomembrane was installed in the Casper Alcova Irrigation District irrigation canal in Casper, WY. The project was completed in January 1991.

Casper, WY, geographical and climatic data (NOAA data*):

- Elevation 5200 ft (1585 m)
- Winter (Dec-Feb) Avg. Low* 12 to16°F (-11 to -9°C)
- Summer (Jun-Aug) Avg. High* 79 to 88°F (26 to 31°C)
- Average Annual Rainfall* 13 in (330 mm)
- Average Annual Snowfall 51 in (1.3 m)
- UV Index 11 plus in the summer

The subgrade in the canal was compacted native soil and the Teranap was placed directly onto the subgrade. The bottom of the canal is approximately 20 feet wide, the angle of the canal walls is approximately 26 degrees, and the flow depth is approximately 6.5 feet.

Three samples were taken from this project in February 2011 to evaluate the membrane's performance after 20 years in place. The three samples were:

A1: Sample taken in an exposed area on the wall of the canal.
A2: Sample taken in an exposed area on the wall of the canal.
B1: Sample taken from beneath sediment in the bed of the canal.

The following conclusions and comments pertain to the RTD Laboratory Report dated June 29, 2011.

Although alligatoring occurred on the surface of the membrane on samples A1 and A2, it had not reached the level of the reinforcement within the cross-section of the membrane. Based on the average depth of the crazing channels, less than 15% of the total membrane thickness was penetrated.

The low temperature flexibility test results were different for the specimens taken from the exposed areas (A1 and A2) and those taken from the unexposed area (B1); 21°F (-6°C) and -11°F (-24°C) respectively. This difference reveals that there is additional heat stress on the membrane in the exposed areas, but that the membrane remains quite flexible in those areas. The membrane sample taken from the protected area shows negligible change in low temperature flexibility compared to when the product was produced.

The sample taken from the bed of the canal (B1) experienced relatively mild and constant temperatures as compared with A1 and A2, and it was not exposed to direct UV and the elements during its service life. Since aging of bituminous materials is primarily a function of heat history and oxygen exposure, the better GPC (gel permeation chromotography) result for B1 is not surprising. Because of this, B1 can be considered the baseline to determine the amount of aging that occurred in the Teranap membrane that was above the water line. The GPC results for A1 and A2 are affirmed by the lower elongation values achieved in the load-elongation tests and in the low temperature flexibility data.

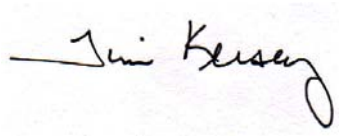
- The exposed areas of the Teranap membrane have lost some of their low temperature flexibility, but the unexposed areas in the canal bed remain virtually unchanged from when the product was first installed.

- Approximately 85% of the total coating thickness remains in the most severely affected areas. Alligatoring of the bitumen surface occurred where the membrane has been directly exposed to the sun, however the reinforcing fabric remains protected as the depth of any erosion in the SBS-modified bitumen coating did not reach the reinforcement.

- The membrane has retained its elongation and tensile strength.

- Based on the GPC curves, the SBS polymer peaks suggest that a significant percentage of SBS synthetic rubber remains chemically intact and functional in the 20 year old exposed membrane. In the B1 sample, there is little change in the polymer's chemical structure compared to when the product was produced.

While it is not prudent to project a specific time period, based on these evaluations this Teranap 431 membrane can be expected to perform for many more years.



Manager, Technical Development

RTD LABORATORY REPORT

To: Tim Kersey

From: Justin Hughes

Date: 29 June 2011

Project Information (Siplast job file)

Project Name:	Casper Alcova Irrigation District
Project Location:	Casper, WY
Construction Date:	Completed January 1991
Area of Membrane Installation:	Approximately 2,000,000 square feet

Assembly

Membrane System		
Ply:	**Product Name:**	**Method of Application:**
Finish	Teranap 431	Loose laid with torch welded seams
Project		
Type:		
Irrigation Canal		

Sample Information

Three Teranap 431 geomembrane samples from the above referenced project were received by the RTD laboratory on February 5, 2011. The samples were submitted to evaluate the product's performance after 20 years in-place.

The samples were analyzed and the following data and conclusions were derived.

Observations

Sample Description: Membrane Layers and Application Methods	
Sample #A1	**Finish Ply**
	Teranap loose laid inside irrigation canal with heat welded seams. (Sample was taken from an area exposed to the elements.)
Sample #A2	**Finish Ply**
	Teranap loose laid inside irrigation canal with heat welded seams. (Sample was taken from an area exposed to the elements.)
Sample #B1	**Finish Ply**
	Teranap loose laid inside irrigation canal with heat welded seams. (Sample was taken from beneath a layer of sediment in the canal bed.)

Sample Description: Sample Size and Surface Appearance		
Sample #A1	**Size:** 590 in^2 (4.1 ft^2)	**Comments:** Crazing was observed on the surface of the Teranap.

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Sample Description: Sample Size and Surface Appearance		
Sample #A2	**Size:** 675 in^2 (4.7 ft^2)	**Comments:** Crazing was observed on the surface of the Teranap.
		
Sample #B1	**Size:** 1279 in^2 (8.9 ft^2)	**Comments:** No obvious signs of product or application issues were visible on the surface of the sample.
		

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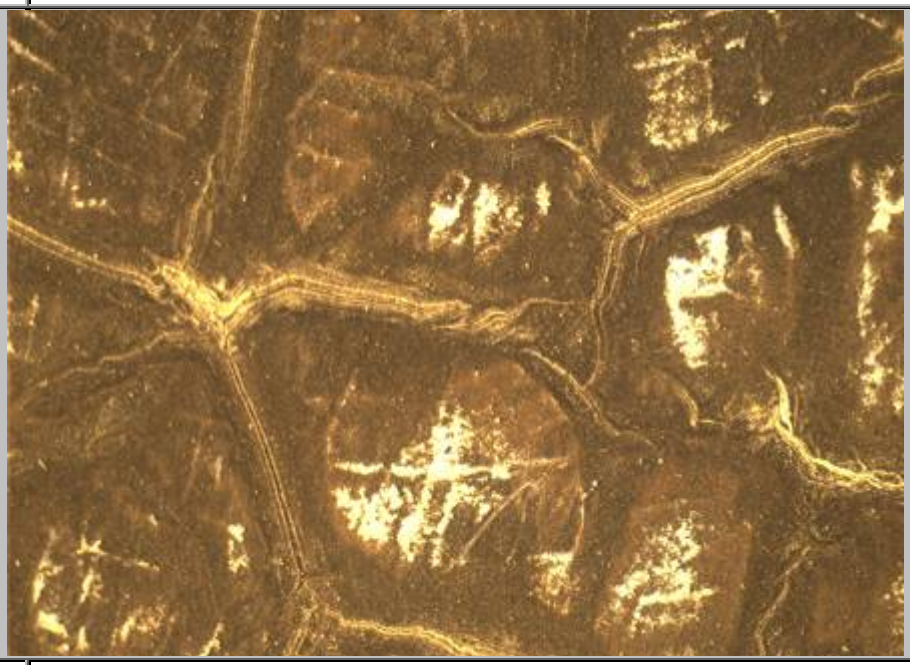
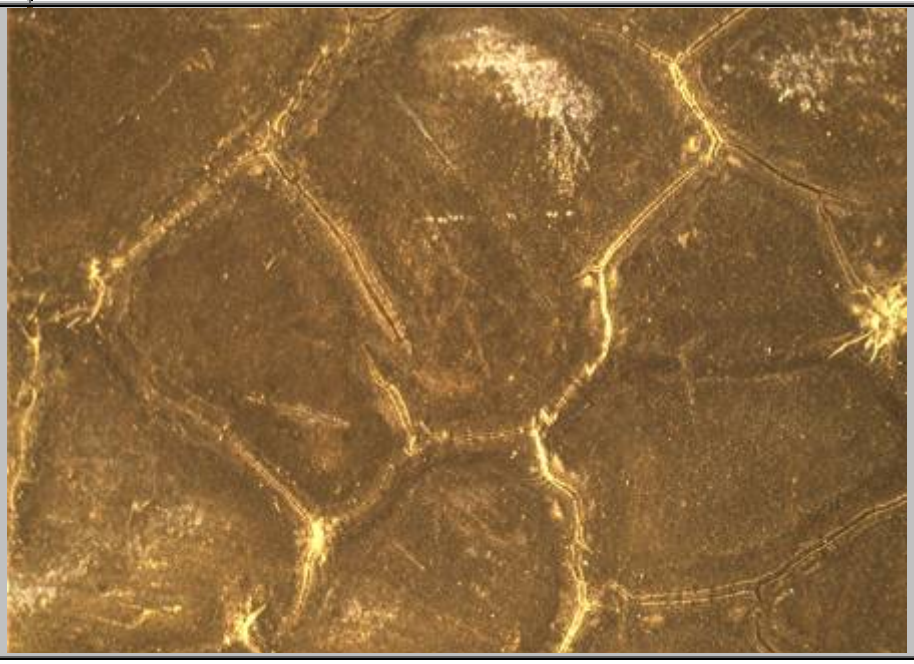
Sample Analysis: Microscope Surface Image	
Sample #A1	The microscope image indicates alligatoring in the surface of the Teranap.

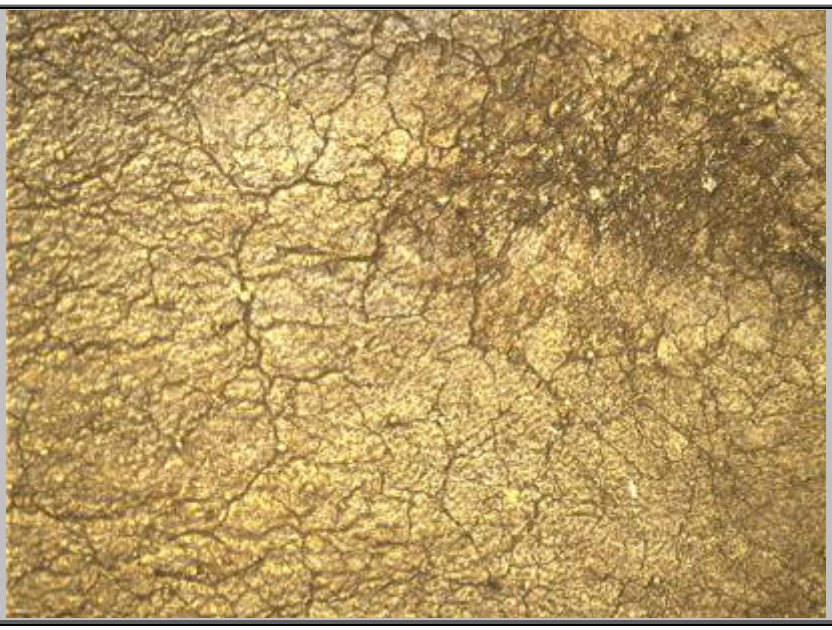


Sample #A2	The microscope image indicates alligatoring in the surface of the Teranap.



Sample Analysis: Microscope Surface Image

Sample # B1	The microscope image indicates checking (minor crazing) on the surface of the Teranap.



Sample Analysis: Microscope Measurement of the Crazing Channel Depth

The depth value depicted in the image is a single measurement. The average depth value reported is based on multiple measurements taken from the samples.

Sample #A1	**Average Channel Depth** 23 mils (0.58 mm)	**Reinforcement Depth** 40 mils (1.02 mm)

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Sample Analysis: Microscope Measurement of the Crazing Channel Depth		
The depth value depicted in the image is a single measurement. The average depth value reported is based on multiple measurements taken from the samples.		
Sample #A2	**Average Channel Depth** 21 mils (0.54 mm)	**Reinforcement Depth** 28 mils (0.70 mm)

Channels were too shallow to measure on sample #B1

Mechanical Properties

	Thickness mils (mm)	Average Peak Load lbf/in (kN/m)	Average Elongation @ Peak Load %	Low Temperature Flexibility °F (°C)
Sample #A1 (exposed)	161 (4.1)	161 (28.2)	62	21 (-6)
Sample #A2 (exposed)	161 (4.1)	160 (28.0)	65	21 (-6)
Sample #B1 (unexposed)	161 (4.1)	159 (28.0)	80	-11 (-24)

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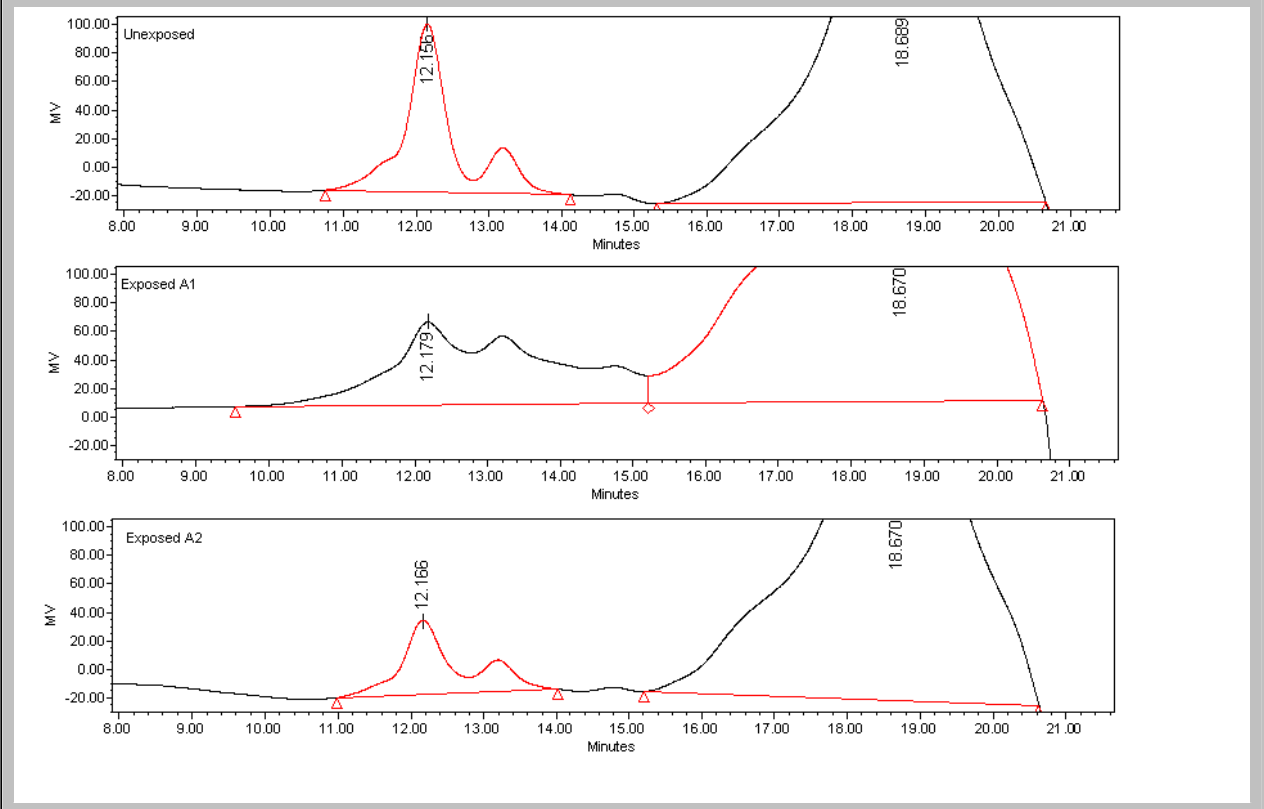
Gel Permeation Chromatography (GPC) Analysis

Comments: The image compares the GPC curves for the individual samples. Based on the results there appears to be some polymer degradation in the exposed samples.



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Jobsite Image

Comments: The image depicts the general condition of the irrigation canal. Note the exposed Teranap on the walls of the canal; this is the general area where Samples A1 and A2 were taken.

Comments: The image indicates where Sample B1 was extracted.

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Conclusions

1. Samples A1 and A2 were taken from the upper wall of the irrigation canal where the membrane was directly exposed to UV light and the elements. These samples exhibited alligatoring on the surface. Microscope imagery indicated that the depth of the crazed SBS bitumen waterproofing did not penetrate to level of the reinforcement within the cross-section of the Teranap.

2. Sample B1 was extracted from beneath a layer of sediment in the bed of the canal. The sample had experienced limited, or no, direct exposure to UV. Due to the water and earth covering it is safe to say that this sample maintained a relatively constant and moderate temperature compared with the exposed samples A1 and A2.

3. Load-elongation tests were conducted and none of the samples experienced a loss of tensile strength compared to the specification values for new material. The elongation values also fell within the specification for new materials. Exposed samples A1 and A2 were 15-18% less than that of B1.

4. Low temperature flexibility tests showed a difference from the specimens taken from the exposed areas to those taken from the unexposed area; 21°F (-6°C) and -11°F (-24°C) respectively. There was little difference between the results of the B1 sample and those of new material.

5. GPC (gel permeation chromatography) analysis was performed on the SBS bitumen, and the exposed samples experienced a higher rate of polymer degradation than B1, however active (intact) SBS polymer remained in both A1 and A2.